STATE OF OHIO
Richard F. Celeste, Governor
DEPARTMENT OF NATURAL RESOURCES
Lt. Gov. Myrl H. Shoemaker, Director
DIVISION OF GEOLOGICAL SURVEY
Horace R. Collins, Chief

SAND AND GRAVEL RESOURCES OF TRUMBULL COUNTY, OHIO

by Dennis N. Hull

1984

Kame resources
- Measured
- Indicated
- Inferred
- Hypothetical
- Buried (generally under 20-50 ft of cover)

Outwash resources
- Measured
- Indicated
- Buried (generally under 20-50 ft of cover)
- Outwash with interstratified lake deposits

Outwash/kame resources
- Measured
- Indicated

- Lake deposits, 30-100 ft thick locally, interstratified with outwash and generally overlain by thin alluvium
- Alluvium
- Alluvium overlying major deposits of outwash

- Sand and gravel pit, active (as of March 1980)
- Sand and gravel pit, intermittently active or abandoned (as of March 1980)
- Water-well location
- Measured-section location
- Boundary of deposit, dashed where approximate
- Approximate boundary of deeply buried (generally under more than 50 ft of cover) sand and gravel

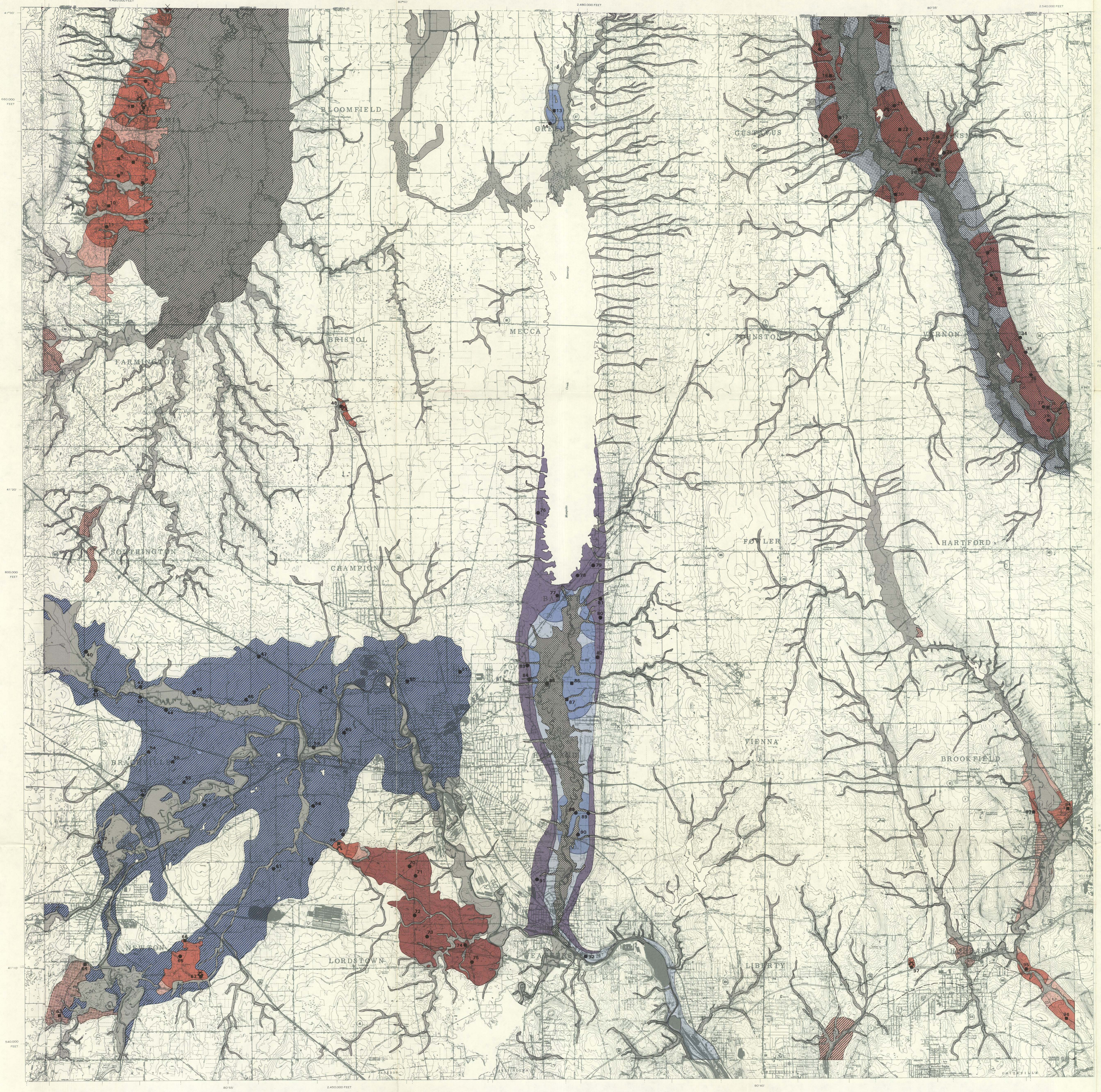


FIGURE 1.—Trumbull County sand and gravel production for the years 1950 to 1982 (Ohio Department of Industrial Relations, 1951-1982, and Division of Geological Survey, 1983, 1984).

TABLE 1.—*Estimated sand and gravel resources, Trumbull County*[1]

Township	Kame Measured	Kame Indicated	Kame Inferred	Outwash Measured	Outwash Indicated	Outwash/kame Measured	Outwash/kame Indicated	Buried kame	Buried outwash	Outwash underlying alluvium
Bazetta				64,379,500	32,960,800				210,917,500	102,416,100
Bloomfield										
Braceville										
Bristol	742,700									
Brookfield	3,746,200	3,301,800								
Champion										
Farmington	65,800	106,593,500								
Fowler										
Greene				13,852,100	1,829,500					
Gustavus						115,050,700	35,852,100			140,977,600
Hartford						2,700,700	38,417,700			24,441,500
Howland				120,020,900	75,559,200				102,139,500	225,842,300
Hubbard	5,427,600	4,715,400								
Johnston										
Kinsman						240,094,000	151,139,000			281,820,100
Liberty			20,843,500		31,461,200					
Lordstown								310,594,800		
Mecca										
Mesopotamia	608,105,200	199,655,100								
Newton	49,767,300	4,682,700								
Southington										
Vernon						227,940,800	148,674,600			229,156,100
Vienna										
Warren	20,042,000	5,619,200						48,946,200		
Weathersfield				6,468,700	5,031,200			105,698,300	78,512,500	49,216,300
TOTAL	687,896,800	324,567,700	20,843,500	204,721,200	146,841,900	585,786,200	374,083,400	465,239,300	391,569,500	1,053,870,000

[1]See accompanying text for definitions of materials and resource categories.

TABLE 2.—*Results of sieve analyses*

Sample no.	Cobble[1] (2.50-10.00 inch diameter; -10.0" +2.5" U.S. Sieve Series)[2]	Pebble (0.157-2.50 inch diameter; -2.5" +5 U.S. Sieve Series)	Granule (0.0787-0.157 inch diameter; -5 +10 U.S. Sieve Series)	Coarse sand (0.0197-0.0787 inch diameter; -10 +35 U.S. Sieve Series)	Medium sand (0.0098-0.0197 inch diameter; -35 +60 U.S. Sieve Series)	Fine sand (0.0025-0.0098 inch diameter; -60 +230 U.S. Sieve Series)	Silt and clay (<0.0025 inch diameter; -230 U.S. Sieve Series)	Total
1A	0	32.9	14.6	35.0	10.1	5.1	2.3	100.0
1B	0	6.5	6.2	38.8	20.0	17.1	11.3	99.9
3	0	4.1	4.8	20.7	20.6	32.0	17.9	100.1
4	0	30.0	15.4	31.2	11.3	7.1	5.0	100.0
15	12.1	39.1	10.6	19.3	10.6	6.0	2.4	100.1
16	0	45.9	10.5	21.2	12.5	6.9	3.0	100.0
19	0	14.0	9.2	37.7	25.3	10.7	3.0	99.9
24	0	13.6	4.0	10.6	16.2	29.6	25.9	99.9
28	0	3.2	2.5	11.2	35.6	38.1	9.4	100.0
30	0	2.0	1.4	12.4	56.4	25.0	2.8	100.0
34	0	0.3	3.0	27.4	35.3	28.2	6.1	100.3
35	0	13.6	13.4	16.0	26.5	24.7	5.8	100.0
37	0	0	0	5.0	24.2	58.6	12.3	100.1
40	0	55.1	9.9	25.0	3.9	2.3	4.0	100.2
44	0	1.2	0.7	2.2	1.8	36.4	57.5	100.0
47	0	0.1	0.2	4.4	12.8	44.4	38.3	100.2
55	0	0.2	0.4	1.0	29.8	52.1	16.7	100.2
60	0	34.1	13.3	34.8	11.5	3.2	3.0	99.9
76	0	7.1	2.8	19.6	29.9	27.4	13.3	100.1
77	0	11.8	7.9	17.5	27.4	32.1	3.3	100.0
84A	10.0	46.6	5.5	10.3	7.1	10.8	9.9	100.2
84B	0	7.0	2.6	10.5	9.9	34.7	35.1	99.8
85	0	27.7	16.8	45.3	7.2	1.8	1.2	100.0
86	0	17.9	13.9	26.7	12.6	18.2	10.6	99.9
87	0	36.2	13.4	19.5	12.7	13.4	4.8	100.0
88	0	17.7	5.7	18.6	16.1	19.9	21.8	99.8

[1]Cobble, pebble, etc. refer to Wentworth grain-size scale; size-class measurements in inches and U.S. Standard Sieve Series for the class in parentheses.
[2]- indicates particle passes through mesh; + indicates particle retained on mesh.

TABLE 3.—*Pebble counts*[1]

Sample no.	Igneous and metamorphic Count	Igneous and metamorphic %	Carbonate Count	Carbonate %	Sandstone Count	Sandstone %	Siltstone Count	Siltstone %	Chert Count	Chert %	Ironstone Count	Ironstone %	Shale Count	Shale %	Clay clasts Count	Clay clasts %	Total Count	Total %
1A					7	35	13	65									20	100
1B	1	5			1	5	17	81	2	10							21	101
4	3	5	2	4	10	18	40	73									55	100
15	2	2			9	7	113	91									124	100
16	7	4			10	5	198	90	4	2							219	101
19	3	6			13	24	34	63	4	7							54	100
24							29	100									29	100
60	10	9			13	12	79	72	8	7							110	100
84A	3	2			6	5	108	89	3	2	1	1					121	99
85	4	7			3	5	51	86	1	2							59	100
86	2	6			5	16	24	77									31	99
87	1	2			10	16	52	81			1	2					64	101
88	3	6			8	16	38	76			1	2					50	100

[1]Samples with fewer than 100 pebbles may not be statistically reliable.

ABSTRACT

Planners and aggregate producers need a thorough understanding of the distribution and quality of sand and gravel resources in Trumbull County if local aggregate production is to keep pace with the rapidly growing demand for aggregate in the Warren-Niles-Youngstown metropolitan area. The map and laboratory analyses generated by this study show that large amounts of potentially mineable sand and gravel are present in the glacial terraces of several stream and river valleys in northwestern, northeastern, and southeastern Trumbull County. Many other sand and gravel deposits throughout Trumbull County are identified in this report; however, factors such as aggregate quality, quantity, and proximity to urban development make many of these deposits less attractive for sand and gravel extraction.

INTRODUCTION

Between 1910 and 1970 the population of Trumbull County increased steadily at an average rate of nearly 3,000 people per year, growing from approximately 53,000 in 1910 to nearly 242,000 in 1980 (Celebrezze, 1980). Projected population is 264,000 in 1990 and 283,100 in 2000 (Program Coordination Section, Office of the Governor, 1978). The development resulting from this expanding population creates a large demand for aggregate-consuming products and services such as housing, highway construction, and highway maintenance. Local sources of sand and gravel are being used to meet much of Trumbull County's aggregate demand. Production of sand and gravel in the county rose substantially between 1950 and 1982, increasing from 62,000 tons in 1950 to 480,359 tons in 1982; peak production of 482,775 tons was reached in 1978 (Ohio Department of Industrial Relations, 1951-1981, and Division of Geological Survey, 1983, 1984). If the projected rate of population growth in Trumbull County is accurate, discovery and development of additional sand and gravel deposits within the county will be necessary in order to keep pace with construction demand. It is very important that local sources of sand and gravel be developed because sand and gravel are relatively low priced commodities that cannot absorb high transportation costs.

This report includes information regarding (1) the geographical distribution of sand and gravel deposits in Trumbull County, (2) the physical characteristics of the material in the deposits, and (3) the location of active, intermittently active, and inactive sand and gravel mining operations. It is hoped that this information will assist commercial sand and gravel operators, land-use planners, and citizens in their collective effort to best utilize the natural resources of Trumbull County.

GEOLOGICAL OCCURRENCE

With the exception of some bedrock ledges and several stream valleys cut into bedrock, nearly all of Trumbull County is mantled with a layer of unconsolidated sediments, most of which were deposited directly or indirectly by Illinoian and Wisconsinan glaciers during the Ice Age. The sediments left by the glaciers in Trumbull County can be grouped into six major types of deposits: (1) end moraine, (2) ground moraine, (3) kame, (4) outwash, (5) eolian (wind deposited), and (6) lacustrine (lake deposited).

End-moraine and ground-moraine deposits together represent more than three-fourths of all surficial materials in Trumbull County. Both types of deposits are composed predominantly of till, which is an unsorted, unstratified mixture of clay, silt, sand, pebbles, cobbles, and boulders.

End moraines are linear, ridgelike accumulations of glacial debris that form along the leading edge of a glacier when the rate of melting at the ice margin is equal to the rate of forward flow. During such periods of ice-front equilibrium, glacial debris trapped in the ice is carried to the front of the glacier and dropped as the enclosing ice melts. A very prominent end moraine, the Defiance Moraine, extends across most of northern Ohio and crosses Trumbull County through Farmington, Southington, Champion, Bazetta, Mecca, Johnston, and Gustavus Townships. In Trumbull County, the Defiance Moraine ranges in relief (height above the surrounding terrain) from 40 to 80 feet and in width from 1 to 3 miles (White, 1971).

Ground-moraine deposits appear as extensive areas of gently rolling topography and form as a result of irregular deposition of glacial debris from the base of a glacier. Ground moraine is the most voluminous glacial deposit in Trumbull County, occurring in large quantities in every township.

End-moraine and ground-moraine deposits may contain isolated small lenses of sand and gravel that can be extracted at a profit; however, such occurrences are relatively rare. The till which dominates morainic material is not an economic source of sand and gravel and is not delineated on the accompanying resource map.

Kames are water-laid deposits of sand and gravel (with minor amounts of silt and clay) that form in crevasses near the leading edge and along the margins of a deteriorating ice sheet. After the ice melts away, these deposits appear as isolated hummocks. Kames are present in Trumbull County in Newton, Warren, Hubbard, and Bristol Townships. Sand and gravel have been mined in all of these deposits.

Kame terraces form along valley walls when meltwaters deposit sand and gravel between the glacial ice in the valley and the valley sides. Kame terraces are present in Trumbull County along the west side of the Grand River valley, the east side of the Pymatuning Creek valley, and along the valleys of Little Deer Creek, Yankee Run, and the Shenango River. The kame terrace along Pymatuning Creek is believed to have been partially reworked during deposition of outwash in the central and western portions of the valley, thus on the accompanying map this deposit is shown as combination outwash and kame.

The kame terrace along the western side of the Grand River valley extends from Farmington Township north through Mesopotamia Township and into Ashtabula County. This terrace, even though covered in places by 60 feet or more of till, contains much of Trumbull County's remaining extractable sand and gravel resources. The largest active commercial sand and gravel operation in Trumbull County is located in this kame terrace at the Ashtabula-Trumbull County line.

Geologic interpretation of water-well records and topography indicates that kame deposits may be buried under 20 to 50 feet of till in eastern Lordstown, southern Warren, and western Weathersfield Townships.

Valley-train outwash is deposited in stream valleys and generally consists of well-sorted sand and gravel. These deposits form as aggregate-laden meltwaters issuing from an ice front move downstream, lose velocity, and drop glacial debris formerly held in suspension. Outwash deposits occur in Trumbull County in the valleys of Eagle Creek, the Mahoning River, Duck Creek, Mosquito Creek, and Pymatuning Creek. The outwash/kame terraces of Pymatuning Creek offer much promise for future commercial sand and gravel extraction because of the quality and quantity of material within the deposit and lack of extensive industrial/residential development in the area. Until 1972 the most productive sand and gravel operation in Trumbull County mined a portion of the Pymatuning Creek deposit 2 miles north of Kinsman.

The outwash deposits of Mosquito Creek south of Mosquito Creek Reservoir and north of the Mahoning River contain large quantities of sand and gravel. Water-well records indicate that these deposits are partially buried along their flanks by 20 to 50 feet of till; thus the actual size of this deposit is much larger than it appears from surface observations. Westward and northward expansion of the populations of Warren and Niles is rapidly precluding much of this deposit from major sand and gravel development; however, if left unmined, this deposit will continue to serve the Warren-Niles community as an increasingly important source of ground water.

Laterally extensive but thin outwash, generally overlain by thin clayey till, occurs in the broad plain near the confluence of Duck Creek, Eagle Creek, and the Mahoning River. The meltwaters which deposited this outwash were slow moving to stagnant, thus the material in the deposit is generally fine grained, containing large quantities of clay, silt, and very fine sand; in many places the outwash grades into lacustrine (lake) sediments. This deposit is shown as outwash with interstratified lake deposits on the accompanying map; however, no resource calculations were made for this deposit because of its predominantly clayey/silty composition. Minor occurrences of coarse sand and gravel, nearly devoid of clay and silt, are present in limited areas of this deposit; detailed exploration might locate some economically attractive aggregate prospects in the area.

Water-well records indicate that a deeply buried (generally more than 50 feet of cover) deposit of sand and gravel, probably outwash, may be present in a buried valley underlying Crab Creek in Liberty Township and extending across Hubbard Township to Masury in Brookfield Township. The physical characteristics and extractability of this material have not been determined; however, this deposit is known as an excellent source of ground water.

Eolian (wind-deposited) sediments of fine sand and silt in places overlie the lake/outwash deposits of Duck Creek, Eagle Creek, and the Mahoning River. These deposits formed as wind reworked the outwash and redeposited the material as low dunes. These small dunes are widely disseminated and are not economically significant as aggregate deposits at this time; thus they are not differentiated on the resource map.

Lacustrine sediments, consisting primarily of silt and clay 30 to 100 feet thick (White, 1971), occupy the floor of the Grand River valley. The lake in which these deposits accumulated formed when glacial ice dammed the northward-flowing Grand River. Postglacial alluvial materials now cover much of these deposits. Much thinner lacustrine deposits (not indicated on the resource map), a few inches to several feet thick, accumulated during an early high-level phase of the Grand River glacial lake and extend southward and eastward into Southington, Bristol, and Champion Townships. Water-well records show that small interstratified lenses of outwash are locally present in the thick lacustrine sediments on the floor of the Grand River valley. These minor outwash deposits are probably not economically extractable at this time.

Deposits of postglacial alluvium also are shown on the resource map. Alluvium consists primarily of clay, silt, fine sand, and organic matter deposited by streams and runoff. The occurrence of alluvium is generally confined to peat bogs and the floodplains of present-day streams. Alluvium generally is not suitable for sand and gravel extraction; however, local occurrences of clean alluvial sand and gravel are mined. Alluvial deposits have been divided into two categories on the resource map: (1) alluvium (which is not believed to overlie major deposits of sand and gravel), and (2) alluvium overlying major deposits of outwash sand and gravel.

RESOURCES

Surficial sand and gravel resources are differentiated on the resource map according to type of deposit and resource category. Alluvium and buried sand and gravel are mapped, but no resource categories based on quantitative information are applied. The resource categories used in this study are defined below.

Measured resources include all sand and gravel within a specific deposit that is within a ½-mile radius of a control point. Control points are sites where data on the thickness of a deposit are available, and may either be locations where field measurements were taken or sites where water wells or borings were drilled into the deposit. Data from these control points are used to determine thicknesses for each *measured* unit; in areas where there are multiple data points, the thickness is computed by averaging the available data.

Indicated resources are defined as sand and gravel associated and contiguous with a measured resource but lying more than ½ mile from a control point. Indicated resource units are assumed to have thicknesses equivalent to contiguous measured deposits. In a case where an indicated unit is bounded by more than one measured unit, the thickness of the measured units are averaged to approximate the thickness of the indicated resource.

Inferred resources are those sand and gravel deposits interpreted to exist on the basis of air-photo interpretation or soil data, but which are not contiguous with a related measured deposit. Thickness of inferred units is estimated from the relief shown on topographic maps where appropriate (*e.g.,* kames).

Hypothetical resources are postulated for those areas where geologic interpretation of the available data suggests the occurrence of sand and gravel, but reliable evidence is lacking. Because the presence of sand and gravel is speculative, no thicknesses are assumed and no resource estimates are made for hypothetical deposits.

The distribution of sand and gravel deposits as shown on the resource map was determined by field examination and geologic interpretation of air photos, soil maps, and water-well records. Field mapping was done using 7½-minute (1:24,000) U.S. Geological Survey quadrangle maps. Average thicknesses (based on water-well records and measured sections) were calculated for each type of deposit and resource category for each township. These thicknesses were then used in conjunction with planimetered acreages to give volumetric and eventually tons-per-township estimates (table 1). The tonnages given in table 1 are approximations of the amount of sand and gravel originally deposited on the land and do not necessarily reflect the actual amount of sand and gravel available for extraction. The amount of sand and gravel previously recovered by mining activity and the amount of sand and gravel precluded from extraction because of overlying development and zoning have not been deducted in the calculations of resource tonnages.

Tonnage estimates were not calculated for sand and gravel associated with lake sediments, deeply buried (generally more than 50 feet of cover) outwash, or alluvial deposits. Tonnage estimates were calculated for buried (generally less than 50 feet of cover) kame and outwash deposits, and for the thick outwash known to underlie the alluvium of Mosquito and Pymatuning Creeks. Thicknesses of these deposits were determined from water-well records or from the average thickness calculated for adjacent unburied portions of the deposits. Total sand and gravel resources in Trumbull County are estimated to be 4,255,419,500 tons.

The resource information contained in this report is not intended to substitute for the detailed investigations that are necessary to determine actual quality and quantity of sand and gravel at any given location. However, general information regarding sand and gravel at specific locations may be obtained by referring to the measured sections and water-well logs included with this report.

ANALYSES

Twenty-six samples of sand and gravel weighing 10 to 20 pounds each were collected for laboratory analysis at selected roadcuts and at nearly all active, intermittently active, and abandoned sand and gravel pits. The collected samples were prepared for sieve analysis by oven drying at 105°C overnight and disaggregating with a mortar and rubber-tipped pestle. The material coarser than the No. 5 sieve of the U.S. Standard Sieve Series (pebbles) was hand sieved, and splits of the material finer than the No. 5 sieve were sieved on a Ro-tap mechanical shaker for 15 minutes. The results of the sieve analyses are presented in table 2. Material greater than ½ inch was used for pebble counts to determine constituent rock types. Pebble counts for samples containing 20 or more pebbles are presented in table 3; it should be noted, however, that pebble counts of fewer than 100 pebbles may not be statistically reliable.

CONCLUSIONS

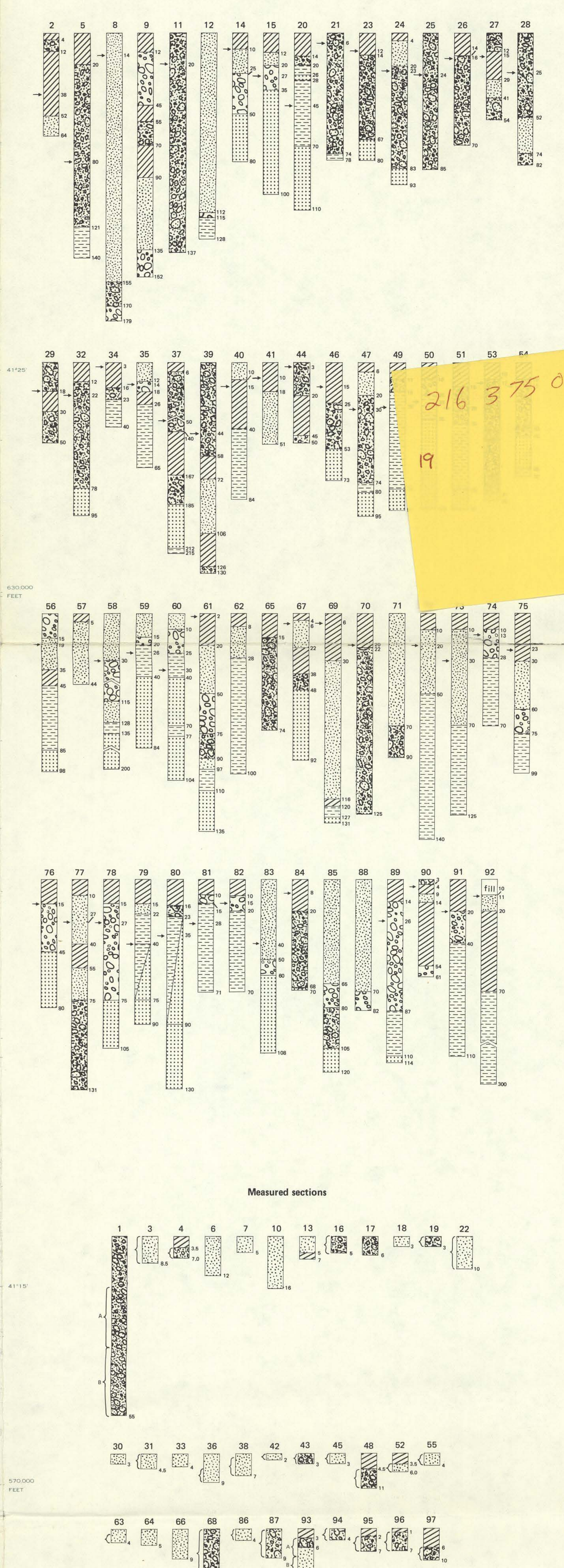
An estimated 4.3 billion tons of sand and gravel are present in Trumbull County, primarily in the terraces of Pymatuning Creek, Yankee Run, Little Deer Creek, and the Grand River. Future exploration for new supplies of sand and gravel in the Warren-Niles-Youngstown metropolitan area should be most successful if concentrated in these terrace deposits.

ACKNOWLEDGMENTS

The author expresses his appreciation to Michele L. Risser for her valuable contribution in the field and laboratory portions of this report, and to the property owners and sand and gravel operators of Trumbull County whose cooperation was essential for the successful completion of this study.

REFERENCES CITED

Celebrezze, A. J., Jr., 1980, Ohio population report, 20th Federal Census: Columbus, Ohio Secretary of State, 216 p.
Division of Geological Survey, 1983, 1981 Report on Ohio mineral industries: Ohio Geological Survey, 71 p.
______1984, 1982 Report on Ohio mineral industries: Ohio Geological Survey, 65 p.
Ohio Department of Industrial Relations, 1949-1981, Division of Mines annual report, 1948-1980: Ohio Department of Industrial Relations.
Program Coordination Section, 1978, Ohio land use element: State of Ohio, Office of the Governor, 177 p.
White, G. W., 1971, Glacial geology of Trumbull County, Ohio: Ohio Geological Survey Report of Investigations 80, map and text.



EXPLANATION

- Clay (represents till in most cases)
- Sand
- Gravel
- Shale
- Sandstone
- fill — Manmade land

87 — Water-well or measured-section number
— Depth in feet to unit contact
Sample interval (measured sections only)
Static ground-water level (water-well logs only)

→ Static ground-water level (information not available for all wells)

VERTICAL SCALE

Water-well logs: 0—0; 50—15; 100 feet—30 meters
Measured sections: 0—0; 5; 25—10; 50 feet—15 meters

BASE COMPILED FROM THE FOLLOWING 7½-MINUTE U.S. GEOLOGICAL SURVEY TOPOGRAPHIC QUADRANGLE MAPS

Bristolville	Newton Falls
Champion	Orangeville
Cortland	Sharon West
Girard	Southington
Gustavus	Warren
Kinsman	West Farmington

County lies within Connecticut Western Reserve

10,000-foot grid based on Ohio Coordinate System, north zone

1 0 1 mile
1 0 1 kilometer

CONTOUR INTERVAL IS 10 FEET
DATUM IS MEAN SEA LEVEL

LOCATION MAP

MN GN 3½° 62 MILS 0°37' 11 MILS

UTM GRID AND 1960 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CARTOGRAPHIC DRAFTING BY DAVID E. RICHARDSON